

19 January 2023

Mr T Forbes
Forest Management Ltd
49 Thames Street
Oamaru 9401

RE: CRC223481 Taiko Stream Flow Assessment: Response to ECan comments on Report

Dear Thomas,

Thank you for asking NIWA to comment on Environment Canterbury's (ECan) review of the reports of Evans and Evans (2022) and Duncan (2022). The review comments are given below.

"The Evans report shows the effects on the MALF(7d) estimate will be zero as Taiko Stream falls dry in the lower reaches under MALF(7d) conditions. The specialist notes that it has therefore been determined that the proposed activity does not have any effect under low conditions.

The specialist has requested that the reduction in flow yield under MALF(7d) conditions be quantified, as the proposed activity would reduce the amount of flow yield generated in the catchment, which would likely reduce the amount of recharge occurring. This would likely increase the extent, frequency and duration of drying occurring in the lower reaches of Taiko Stream."

With reference to the first paragraph of the review and to Figure C of Evans and Evans (2022) (an isohyd map of the 7-day MALF of Taiko Stream), the reviewer should note that this map, based on data provided by ECan, shows that the whole catchment has a 7-day MALF of 0 L/s. Thus, the comment that *"the proposed activity does not have any effect under low flows conditions"* is correct. However, the assumption that *"Taiko Stream falls dry in the lower reaches under MALF(7d) conditions"* is not quite correct as the isohyd map shows that the whole of the catchment has a 7-day MALF of 0 L/s, not just the lower reaches.

With reference to the second paragraph of the review it is not possible to quantify any reduction in low flow water yield and its effect on drying reaches (of the whole catchment) with any certainty. While, in theory, afforestation of a short grassland catchment reduces flow, when the proportion of the catchment afforested is small (12.6% for all "new" forest (Evans and Evans, 2022)) detection of any flow change becomes problematic. International research has long established (Bosch and Hewlett (1982) and Stednick (1996)) that any land cover change of less than 20% of the catchment area cannot be detected using conventional hydrological measurements. Any flow change due to afforestation is likely to be small and would be masked by the annual variation in flow, i.e., if the flow changes from year to year it would not be possible to distinguish between the effect of climate variability or afforestation.

In summary, because of the small proportion of the catchment afforested, it is not possible to quantify any flow reduction due to afforestation with any certainty, so no defensible comments can be made regarding any changes to “*the extent, frequency and duration of drying occurring in the lower reaches of Taiko Stream*”.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Maurice Duncan', with a stylized, cursive script.

Maurice Duncan
Hydrologist

References:

- Bosch, J.M., Hewlett, J.D. (1982) A review of catchment experiments to determine the effect of vegetation changes on water yield and evapotranspiration. *Journal of Hydrology*: 55:3-23.
- Duncan, M.J. (2022) Hydrological effects of afforestation of the Taiko Stream. *NIWA Client Report 2022353CH*, 12p.
- Evans, M.J., Evans, P.H. (2022) Effects of a proposed forest on the Taiko Stream flow sensitive catchment. Forest Management Ltd. 13 p.
- Stednick, J.D. (1996) Monitoring the effects of timber harvest on annual water yield. *Journal of Hydrology*: 176:79-65.